

CLAIMS

- 5 1. A process for the treatment of at least one particle (10 - 14) with at least one reaction liquid (20, 21) in a main channel (30) of a fluidic microsystem (100), with the steps:
- movement of the at least one particle (10 - 14) with a carrier liquid (40) flowing in a longitudinal direction of
 - 10 the main channel up to a holding device (50, 52, 57),
 - at least a temporary holding of the at least one particle (10 - 14) under the action of a holding force exerted by the holding device (50, 52, 57), and
 - supplying of the reaction liquid (20, 21) from at least one
 - 15 lateral channel (31, 36) into the main channel (30) so that the at least one held particle (10 - 14) is rinsed by the reaction liquid (20, 21),

characterized in that

- the holding device (50, 52, 57) is arranged downstream after a mouth (32, 37) of the lateral channel (31, 36) into the
- 20 main channel (30) and the reaction liquid (20, 21) flows through the holding device (50, 52, 57) with a direction of flow running in the longitudinal direction of the main channel (30).

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2. The process according to Claim 1, in which the at least one particle (10 - 14) is held in the holding device (50, 52, 57) on a local potential minimum or along a potential line extending perpendicularly to the longitudinal direction of
- 30 the main channel (30).

3. The process according to Claim 1 or 2, in which the at least one particle (10 - 14) is held by the holding device (50, 52, 57) on a side of the main channel (30) limited by a

channel wall in which the mouth of the lateral channel (31, 36) is formed.

4. The process according to Claim 1 or 2, in which the at
5 least one particle is held by the holding device (50, 52, 57)
in the middle of the main channel.

5. The process according to at least one of the preceding
claims, in which the at least one particle is held by the
10 holding device with dielectrophoretical, optical and/or
acoustically imparted holding forces.

6. The process according to Claim 6, in which the at least
one particle is held by the holding device (50, 52, 57) by a
15 combination of dielectrophoretical, optical and/or acousti-
cally imparted holding forces and flow forces.

7. The process according to Claim 6, in which a field barrier
is generated with the holding device (50, 52) which barrier
20 narrows down in the longitudinal direction of the main chan-
nel down to the local potential minimum.

8. The process according to Claim 6, in which at least one
field barrier is generated with the holding device (57) which
25 barrier extends linearly and perpendicularly to the longitu-
dinal direction of the main channel.

9. The process according to at least one of the preceding
claims, in which at least one measurement on the particle
30 takes place in the holding device (50, 52, 57).

10. The process according to Claim 6, in which at least one
reference measurement takes place on at least one reference
particle (15) in a reference holding device (70), the refer-

ence particle (15) being exposed in the reference holding device (70) exclusively to the carrier liquid (40) without the reaction liquid or some another reaction liquid.

5 11. The process according to at least one of the preceding claims, in which the at least one reaction liquid (20) is washed in as a segmented liquid column in which active segments (21) alternate with the at least one reaction liquid and passive segments (22) of a barrier liquid.

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12. The process according to at least one of the preceding claims, in which the at least one particle is positioned at an distance in a range of 50 μm to 4 mm from the mouth (32, 37) of the lateral channel (31, 36).

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13. The process according to at least one of the preceding claims, in which a release of the at least one particle (10-14) from the holding device (50, 52, 57) and another movement of the at least one particle (10-14) in the main channel (30) or a discharge channel (38) take place after the holding of the at least one particle (10-14) and the supplying of the reaction liquid (20, 21).

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14. The process according to Claim 13, in which the movement into the main channel (30) or the discharge channel (38) takes place as a function of a result of the measurement on the at least one particle (10-14) in the holding device (50, 52, 57).

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15. The process according to Claim 14, in which the movement of the at least one particle (10-14) into the main channel or the discharge channel (30, 38) results in a sorting of particles with predetermined properties into the main channel (30).

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16. The process according to at least one of claims 13 to 15, in which the movement into the discharge channel (38) comprises a deflection of the at least one particle (10-14) under the action of high-frequency electrical fields.

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17. The process according to at least one of the preceding claims, in which the at least one lateral channel (31, 36) is separated from the main channel (30) by a dielectrophoretical field barrier so that no particles can enter into the lateral
10 channel (31, 36).

18. The process according to at least one of the preceding claims, in which a field barrier is generated during the holding of the at least one particle (10-14) and the supply-
15 ing of the reaction liquid (20, 21) on the upstream side of the holding device (50, 52, 57) with which field barrier particles flowing in subsequently are retained or deflected from the holding device (50, 52, 57).

20 19. A fluidic microsystem (100), especially for the treatment at least one particle (10-14) suspended in a carrier liquid (40), which comprises:

- a main channel (30) adapted to receive a flow of the carrier liquid (40) and to which a lateral channel (31, 36) for
25 supplying a reaction liquid (20, 21) is connected at least one mouth (32, 37), and
- a holding device (50, 52, 57) designed to hold at least temporarily the at least one particle (10-14),

characterized in that

- 30 - the main channel (30) is adapted to receive a flow of the reaction liquid (20, 21) that flows with a direction of flow running in the longitudinal direction of the main channel (30) through the holding device (50, 52, 57), and

- the holding device (50, 52, 57) is arranged downstream after the mouth (32, 37) of the lateral channel (31,36).

20. The microsystem according to Claim 19, in which the holding device (50, 52, 57) is adapted to generate at least one local potential minimum or at least one potential line extending perpendicularly to the direction of flow of the reaction liquid.

21. The microsystem according to Claim 19 or 20, in which the holding device (50, 52, 57) is arranged on a side of the main channel (30) limited a the channel wall in which the mouth of the lateral channel (31, 36) is formed.

22. The microsystem according to Claim 19 or 20, in which the holding device (50, 52, 57) is arranged in the middle of the main channel.

23. The microsystem according to at least one of the preceding claims 19 to 22, in which the holding device (50, 52, 57) is designed to exert dielectrophoretical, optical and/or acoustically imparted holding forces.

24. The microsystem according to Claim 23, in which the holding device (50, 52) is adapted to form a dielectrical field barrier that narrows down in the longitudinal direction of the main channel to a local potential minimum.

25. The microsystem according to Claim 24, in which the holding device (52) comprises at least one central electrode (54) centrally arranged on the downstream side of the holding device (52).

26. The microsystem according to Claim 25, in which the holding device (52) comprises at least two lateral electrodes (53, 55) extending on the upstream side of the central electrode (54) into the channel.

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27. The microsystem according to Claim 26, in which the holding device (52) comprises at least one counterelectrode (56) arranged on the upstream side of the lateral electrodes (53, 55).

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28. The microsystem according to Claim 23, in which the holding device (57) is adapted to form at least one field barrier extending linearly and transversely to the longitudinal direction of the main channel.

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29. The microsystem according to at least one of the preceding claims 19 to 28, in which at least one measuring device (80) is provided for measuring the particle in the holding device (50, 52, 57).

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30. The microsystem according to Claim 29, in which at least one reference measuring device (90) is provided for reference measuring on at least one reference particle in a reference holding device (70).

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31. The microsystem according to at least one of the preceding claims 19 to 30, in which the holding device (50, 52, 57) is provided for the purpose of positioning the at least one particle at a distance in a range of 50 μm to 4 mm from the mouth (32, 37) of the lateral channel (31, 36).

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32. The microsystem according to at least one of the preceding claims 19 to 31, in which at least one discharge channel

(38) is arranged downstream after the holding device (50, 52, 57).

33. The microsystem according to Claim 31, in which at least one sorting electrode (66a, 66b) is provided between the holding device (50, 52, 57) and the at least one discharge channel (38).

34. The microsystem according to at least one of the preceding claims 19 to 33, in which at least one barrier electrode (67) is arranged in the at least one lateral channel (31, 36) that prevents particles from entering into the at least one lateral channel (31, 36).

35. The microsystem according to at least one of the preceding claims 19 to 34, in which one screening electrode (65) is arranged between the mouth (32, 37) of the at least one lateral channel (31, 36) and between the holding device (50, 52, 57) with which screening electrode the particles can be retained or deflected from the holding device (50, 52, 57).

36. An electrode arrangement (52) for holding suspended particles in a channel of a fluidic microsystem, which arrangement comprises at least three pairs of electrodes (53, 54, 55), the electrodes (53, 54, 55) being respectively arranged on bottom surfaces and cover surfaces of the channel and each comprising a central electrode (53) and two lateral electrodes (54, 55), the central electrodes (53) being adapted to form a dielectrical field barrier transversely to a direction of flow (A) in the channel when loaded with a high-frequency alternating voltage, and the lateral electrodes (54, 55) being arranged in front of the central electrode (53), relative to the direction of flow (A).

37. The electrode arrangement according to Claim 36, in which at least one of the central electrodes (53) has a broadening on its free end.

5 38. The electrode arrangement according to Claim 36 or 37, that is provided with at least one counterelectrode (56) operated on mass potential or free (floating) potential and arranged centrally in front of the lateral electrodes (54, 55), relative to the direction of flow (A).

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39. An electrode arrangement (57) for holding suspended particles in a channel of a fluidic microsystem, which electrode arrangement comprises at least one pair of straight electrode strips (58) arranged on the bottom and cover surfaces of the
15 channel and extending transversely to the longitudinal direction of the channel.

40. The electrode arrangement according to Claim 39, in which the electrode strips (58) are aligned opposite each other on
20 the bottom and cover surfaces.

41. The electrode arrangement according to Claim 39, in which the electrode strips (58) are aligned in an offset manner on the bottom and cover surfaces.

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